

## REPORT DOCUMENTATION PAGE

*Form Approved  
OMB No. 0704-0188*

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate only, other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.		
1. AGENCY USE ONLY (LEAVE BLANK)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	25 March 1999	Abstract
4. TITLE AND SUBTITLE  Effects of Physiologic Heat Stress on Cognitive Performance during Simulated Flight Tasks		5. FUNDING NUMBERS
6. AUTHOR(S)  Barry Shender    Gregory Askew    Jonathan Kaufman Linda Schaaf		8. PERFORMING ORGANIZATION REPORT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  Naval Air Warfare Center Aircraft Division 22347 Cedar Point Road, Unit #6 Patuxent River, Maryland 20670-1161		10. SPONSORING/MONITORING AGENCY REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  Naval Air Systems Command 47123 Buse Road, Unit IPT Patuxent River, Maryland 20670-1547		11. SUPPLEMENTARY NOTES
12a. DISTRIBUTION/AVAILABILITY STATEMENT  Approved for public release; distribution is unlimited.		12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words)  It is known that heat stress leads to reduced +Gz-tolerance in tactical aircrew. The first phase of an effort to determine the relationship between physiologic heat stress and flight performance was conducted using the new NAWCADPAX flight simulator installed in an environmental chamber. Performance scores declined after subjects were exposed to the hot alert conditions relative to control, though the difference was not statistically significant. Correlation analysis indicated a marginal relationship between the change in performance and rectal and mean skin temperatures ( $r=0.59$ and $0.55$ , respectively). The experimental design did not account for the increased generation of metabolic heat associated with straining against high G forces, though it did include radiant heat loads. The next phase will include physical work in the cockpit to account for this additional factor.		
14. SUBJECT TERMS  Physiologic heat stress    flight performance    +Gz		15. NUMBER OF PAGES  1
16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT  Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE  Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT  Unclassified
		20. LIMITATION OF ABSTRACT  UL

19991004 130

EFFECTS OF PHYSIOLOGIC HEAT STRESS ON COGNITIVE PERFORMANCE  
DURING SIMULATED FLIGHT TASKS

BS Shender\*, G. Askew, J., Kaufman\*, L. Schaaf. NAWCAD, Patuxent River, MD

INTRODUCTION: It is known that heat stress leads to reduced +Gz-tolerance in tactical aircrew. The first phase of an effort to determine the relationship between physiologic heat stress and flight performance was conducted using the new NAWCADPAX flight simulator installed in an environmental chamber. METHODS: 8 male volunteers ( $32.4 \pm 8.5$  yr,  $79.6 \pm 10.8$  kg) wearing full Combat Edge equipment, enhanced coverage anti-G suit, survival vest, and torso harness participated. The environmental conditions during an ALERT scenario were simulated including pre- and post flight brief, pre- and post flight aircraft inspection, alert, and 90 min flight. Ambient conditions were: brief:  $T_{db} = 22^\circ\text{C}$ , 45% RH; aircraft inspection and alert:  $T_{db} = 44^\circ\text{C}$ ,  $T_{bg} = 49^\circ\text{C}$ , 40% RH; flight:  $T_{db} = 27^\circ\text{C}$ ,  $T_{bg} = 37^\circ\text{C}$ , 40% RH. Data were collected during two separate days under these conditions and a single control day with chamber conditions at  $T_{db} = 27^\circ\text{C}$ ,  $T_{bg} = 37^\circ\text{C}$ , 40% RH. During inspections, subjects exercised on a bicycle ergonometer at 40% of their VO<sub>2</sub>max. Rectal and skin temperatures (10 sites), heat flux (7 sites), and ECG were monitored. Subjects flew three different tail chase scenarios which were generated using a highly textured video graphical display and an F-18 aeromodel. Flight information was displayed on a HUD and subjects flew with a control stick and throttle. Scenarios included low (constant azimuth, varying altitude), medium (constant altitude high +Gz turns), and high workloads (varying altitude and turns). Flight performance was determined by comparison to the target aircraft. RESULTS: Performance scores declined after subjects were exposed to the hot alert conditions relative to control, though the difference was not statistically significant. Correlation analysis indicated a marginal relationship between the change in performance and rectal and mean skin temperatures ( $r=0.59$  and 0.55, respectively). CONCLUSIONS: The experimental design did not account for the increased generation of metabolic heat associated with straining against high G forces, though it did include radiant heat loads. The next phase will include physical work in the cockpit to account for this additional factor.

CLEARED FOR  
OPEN PUBLICATION

3-25-99

PUBLIC AFFAIRS OFFICE  
NAVAL AIR SYSTEMS COMMAND

*H. Howard*